

High curie-temperature ferromagnetism in cobalt-implanted single-crystalline rutile

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Abstract

The ion implantation technique has been used to fabricate a Co-rich layer in rutile: single-crystalline TiO₂ substrates were heavily irradiated by Co⁺ ions with energy of 40 keV. The magnetic properties of as-prepared and post-annealed samples were studied by both inductive and Faraday magnetometry as well as ferromagnetic resonance (FMR). A ferromagnetic Curie temperature as high as 700 K was measured in our samples. The analysis of the magnetic hysteresis loop, the temperature dependence of the saturation magnetization, and strong out-of-plane anisotropy of the FMR spectra allow us to suppose that the origin of the macroscopic high-temperature ferromagnetism is the exchange interaction mediated by oxygen vacancies.

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